PTO 05-6002

CY=JA DATE=19920114 KIND=A
PN=04-010569

PHOTOELECTRIC CONVERTER
[Koudenhenkan souchi]

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UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. September 2005

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(19):	JP
DOCUMENT NUMBER	(11):	04010569
DOCUMENT KIND	(12):	A [PUBLISHED UNEXAMINED APPLICATION]
PUBLICATION DATE	(43):	19920114
APPLICATION NUMBER	(21):	020110471
APPLICATION DATE	(22):	19900427
INTERNATIONAL CLASSIFICATION	(51):	H 01 L 27/146; H 04 N 5/335
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APPLICANT	(71):	CANON INC.
TITLE	(54):	PHOTOELECTRIC CONVERTER
FOREIGN TITLE	(54A):	KOUDENHENKAN SOUCHI

SPECIFICATION /363*

1. Title of the Invention

PHOTOELECTRIC CONVERTER

2. Claims

(1) With respect to a photoelectric converter in which charge-sensitive sensors that accumulate photoelectrically converted charges in control electrodes and that output signals corresponding to said charges from one side of the main electrodes are two-dimensionally disposed and in which multiple signal lines that have connected commonly to them the control electrodes of the above-mentioned charge-sensitive sensors aligned in one direction are disposed,

a photoelectric converter characterized by

a refresh operation for the charge-sensitive sensors connected to the signal lines that are being read being carried out by means of a first refresh operation in which control electrodes are set to a prescribed potential and a second refresh operation in which a prescribed forward voltage is applied to the control electrodes via the main electrodes on the output side

and a refresh operation for the charge-sensitive sensors connected to the signal lines that are not being read being carried out by means of only the above-mentioned second refresh operation.

(2) A photoelectric converter of Claim 1 in which a signal reading operation, the first refresh operation, and the second refresh operation are performed for the charge-sensitive sensors of the signal lines that are being read during a prescribed period and in which the second refresh operation is

* Numbers in the margin indicate pagination in the foreign text.

performed for the charge-sensitive sensors of the signal lines that are not being read during a period other than the above-mentioned prescribed period.

3. Detailed Explanation of the Invention

[Field of Industrial Application]

The present invention pertains to photoelectric converters, specifically to photoelectric converters in which charge-sensitive sensors that accumulate photoelectrically converted charges in control electrodes and that output signals corresponding to said charges from one side of the main electrodes are two-dimensionally disposed and in which multiple signal lines that have connected commonly to them the control electrodes of the above-mentioned amplifying sensors aligned in one direction are disposed.

[Related Art]

In the following, one example of a photoelectric converter will be explained. /364

Figure 6 is a schematic structural drawing of one example of a photoelectric converter.

In the figure, in a photoelectric converting part [201] in which sensor cells are aligned in m × n, television scanning is carried out by means of a vertical scanning part [202] and a horizontal scanning part [203]. From the vertical scanning part [202], scan signals are output through horizontal signal lines, [XL_1] ~ [XL_n], and signals are input from the sensors to the horizontal scanning part [203] through vertical signal lines, [YL_1] ~ [YL_n].

Signals output from the horizontal scanning part [203] are output

as standard television signals through a processing circuit [204].

The driving pulses, [Φ_{HS}], [Φ_{H1}], [Φ_{H2}], and [Φ_{VS}], [Φ_{V1}], [Φ_{V2}], etc. of the vertical scanning part [202] and horizontal scanning part [203] are supplied by means of a driver [205]. Moreover, the driver [205] is controlled by means of a controller [206].

Below, the vertical scanning part of the above-mentioned photoelectric converter will be explained.

Figure 7 is a structural drawing of the vertical scanning part and a part of the photoelectric converting part of the photoelectric converter.

Figure 8 is a waveform chart for explaining the operations of the vertical scanning part and photoelectric converting part.

In addition, the sensor cells are gate-isolation-type sensors mentioned in Tokugan No.62-17150. n line sensors are aligned in m rows, making up an m × n area sensors. As indicated in Fig. 7, the control electrodes [4] of the sensors are commonly connected to each of the horizontal signal lines, [XL_1] ~ [XL_n] (only the horizontal signal lines, [XL_1] ~ [XL_4], are indicated in Fig. 7), via capacitances, and these horizontal signal lines, [XL_1] ~ [XL_n], are individually connected to the parallel output terminals of the vertical scan signal generating part [1] via buffer transistors [6].

As indicated in Fig. 8, when a pulse [Φ_{V1}] and a pulse [Φ_{V2}] are input to the vertical scan signal generating part [1] during a V effective period, the vertical scan signal generating part [1] outputs scan signals in accordance with the timing. Then, buffer transistors [6] connected to the signal lines, [VL_1] ~ [VL_m] (only the signal lines, [VL_1] ~ [VL_4], are indicated in Fig. 7), become selected and turned on sequentially,

and a driving voltage [Φ_n] becomes sequentially applied to the horizontal signal lines, [XL_1] ~ [XL_m]. The rows of the output electrodes [3] of the sensors are connected to the vertical signal lines, [YL_1] ~ [YL_n], respectively. As the driving voltage [Φ_n] changes, a photoelectrically converted signal becomes output from the sensor connected to a selected horizontal signal line to the vertical signal lines.

During a V blanking period, the pulse [Φ_{V1}] and the pulse [Φ_{V2}] do not become input, the buffer transistors [6] are off, the horizontal signal lines, [XL_1] ~ [XL_n], are in a floating state, and the sensors are in an accumulating mode.

[Problem that the Invention is to Solve]

Some information processing devices that utilize the above-described photoelectric converters are required to have a function for reading at a high speed only the information of the area sensors that are connected to part of the horizontal signal lines (e.g. horizontal signal lines, [XL_1] ~ [XL_n], in Fig. 6).

In such case, since the above-described photoelectric converter sequentially scans and reads all of the horizontal signal lines, [XL_1] ~ [XL_m], during a V effective period, horizontal signal lines that do not need to be read become controlled in the same manner as the horizontal signal lines that need to be read, and this creates a problem of a poor reading efficiency.

[Means for Solving the Problem]

With respect to a photoelectric converter in which charge-sensitive sensors that accumulate photoelectrically converted charges in control electrodes and that output signals corresponding to said charges from

one side of the main electrodes are two-dimensionally disposed and in which multiple signal lines that have connected commonly to them the control electrodes of the above-mentioned charge-sensitive sensors aligned in one direction are disposed, the above problem can be solved by a photoelectric converter of the present invention characterized by

a refresh operation for the charge-sensitive sensors connected to the signal lines that are being read being carried out by means of a first refresh operation in which control electrodes are set to a prescribed potential and a second refresh operation in which a prescribed forward voltage is applied to the control electrodes via the main electrodes on the output side, and

a refresh operation for the charge-sensitive sensors connected to the signal lines that are not being read being carried out by means of only the above second refresh operation.

[Operation of the Invention]

Charge-sensitive sensors, which accumulate photoelectrically /365
converted electric charges in control electrodes and which output signals corresponding to said charges from one side of main electrodes, need to discharge the charges accumulated in the control electrodes by means of a refresh operation. In this case, discharging is carried out by executing a first refresh operation in which the control electrodes are set to a prescribed potential and by then executing a second refresh operation in which a forward voltage is applied to the control electrodes through the output-side main electrodes. By this, the remaining charges in the control electrodes become discharged.

These two refresh operations are carried out to eliminate the

influence of the charges remaining in the control electrodes. When it is desired that the information of only the sensors that are connected to some of the signal lines (e.g., the horizontal signal lines, [XL_1] ~ [XL_n], in Fig. 6) be read, the charge-sensitive sensors connected to the signal lines not being read should be subjected to a refresh operation in a manner such that the electric potentials of the control electrodes will not rise above the prescribed potential and cause the charges to flow from the output-side main electrodes as a result.

According to the invention, the speeds of control operations are increased by performing only the second refresh operation as the refresh operation for the charge-sensitive sensors connected to signal lines that are not being read.

In addition, by performing a signal reading operation, the first refresh operation, and the second refresh operation for the charge-sensitive sensors of the signal lines being read during a prescribed period and by performing the second refresh operation for the charge-sensitive sensors of the signal lines not being read during a period other than the above-mentioned prescribed period, information can be read from the charge-sensitive sensors of selected signal lines at a higher speed. Moreover, the refresh operation of the charge-sensitive sensors of the signal lines not being read can be performed during the accumulation period of the charge-sensitive sensors of the signals being read. Therefore, the control operations can be made more efficient.

[Embodiments of the Invention]

In the following, embodiments of the invention will be explained in detail by using drawings.

Figure 1 is a circuit diagram indicating one embodiment of a photoelectric converter of the invention.

Figure 2 is a waveform chart for explaining the operation of the above-mentioned photoelectric converter.

In addition, the basic structure of the photoelectric converter is the same as that of the converter indicated in Fig. 6.

The sensor cells of this photoelectric converter are the same as the gate-isolation-type sensors of Fig. 7 which are mentioned in Tokugan No.62-17150 and n line sensors are aligned in m rows, making up an m × n area sensors. The control electrodes [4] of the sensors are commonly connected to each of the horizontal signal lines, [XL_1] ~ [XL_n] (only the horizontal signal lines, [XL_1] ~ [XL_4], are indicated in Figure 1), via capacitances, and these horizontal signal lines, [XL_1] ~ [XL_n], are individually connected to the parallel output terminals of a vertical scan signal generating part [1] via buffer transistors [6].

Moreover, the vertical scan signal generating part [1] outputs control signals in accordance with the timings of a pulse [Φ_{V1}] and a pulse [Φ_{V2}] and a driving voltage [Φ_n] becomes sequentially output to the horizontal signal lines, [XL_1] ~ [XL_m], through the buffer transistors [6]. The rows of the output electrodes (output-side main electrodes) [3] of the sensors are connected to each of the vertical signal lines, [YL_1] ~ [YL_n] (only the vertical signal lines, [YL_1] ~ [YL_4], are indicated in Fig. 1). The vertical signal lines, [YL_1] ~ [YL_n], are connected to accumulation capacitor [C_t] via MOS transistors [Q_n], and the accumulation capacitors [C_t] are connected to an output line [SL] via the MOS transistors [Q_n]. The MOS transistors [Q_n] are driven by means of the horizontal scan

signal generating part [2], and the horizontal scan signal generating part [2] outputs control signals in accordance with the timings of a pulse [Φ_{H1}] and a pulse [Φ_{H2}]. Moreover, the control electrodes [4] of the sensors are connected to P-type MOS transistors [5]. Moreover, the vertical signal lines, [YL_1] ~ [YL_n], are also connected to MOS transistors [Q_r].

In the following, the operation of the above-mentioned photoelectric converter will be explained by using Fig. 2.

In Fig. 2, after a pulse [Φ_{VS}] is input to the vertical scan signal generating part [1], the vertical scan signal generating part [1] selects a horizontal signal line for each row every time a pulse [Φ_{V1}] and a pulse [Φ_{V2}] are input. In the present invention, the horizontal signal /366
lines that need to be read are selected during a V effective period and the rest of the horizontal signal lines that do not need to be read are selected during a V blanking period. These selections are controlled by a controller [206] indicated in Fig. 6 in this embodiment.

The operations performed during a V effective period and a V blanking period will be explained in detail by using Figs. 3 and 4.

Figure 3 is a magnified partial waveform chart of the part [A] of the V effective period, and Fig. 4 is a magnified partial waveform chart of the part [B] of the V blanking period.

When the pulse [Φ_{V1}] and the pulse [Φ_{V2}] are input during the V effective period, prescribed horizontal signal lines that will be read become selected. After that, the pulse [Φ_{VC}] and the pulse [Φ_{V7}] become set from the low levels to the high levels, causing the vertical signal lines, [YL_1] ~ [YL_n], and the accumulation capacitors [C_t] to become reset.

When the driving voltage [Φ_n] is set from the middle level to the high level while holding the pulse [Φ_7] at the high level, the potentials of the control electrodes [4] of the sensors rise. As a result, signals corresponding to the accumulated signal charges become output from the output electrodes [3] to the vertical signal lines, [YL_1] ~ [YL_n], and the signals become charged in the accumulation capacitors [C_t].

After that, by setting the driving voltage [Φ_n] from the high level to the low level (negative potential), the P-type MOS transistors [5] become turned on and the control electrodes [4] of the sensors become refreshed (hereafter, referred to as complete refreshing) to a prescribed potential ([GND] in this case). The complete refreshing interval is about 60μsec. Next, the driving voltage [Φ_n] is returned from the low level (negative potential) to the high level in order to increase the potentials of the control electrodes [4] of the sensors, and the MOS transistors [Q_7] are turned on in order to refresh (hereafter referred to as transient refreshing) the charges remaining in the control electrodes [4]. The transient refreshing interval is several μ seconds. After that, the driving voltage [Φ_n] is set from the high level to the middle level and an accumulating operation becomes started.

When the pulse [Φ_{V1}] and the pulse [Φ_{V2}] are input during a V blanking period, prescribed horizontal signal lines that will be not read become selected. Then, the driving voltage [Φ_n] becomes set from the middle level to the high level in order to increase the potentials of the control electrodes of the sensors and the pulse [Φ_{VC}] is set from the low level to the high level in order to turn on the MOS transistors [Q_r]. Thus, the charges of the control electrodes become transient-refreshed. In other

words, the cells not being read are subjected only to transient refreshing and not to complete refreshing, charge transferring, etc.

In addition, this V blanking period is an accumulation period for the prescribed horizontal signal lines being read, but the accumulated charges will not flow out since the voltages of the control electrodes [4] with respect to the output electrodes [3] will not be more than the prescribed voltage necessary for reading.

Moreover, non-interlace scanning was described in the above embodiment, but the invention can also be applied to interlace scanning by providing multiple types of pulses [Φ_n] and by disposing and driving separate buffer transistors. Furthermore, as indicated in Fig. 5, by shifting the pulse [Φ_{VS}] and the V effective period, it becomes possible to read signals not only from the horizontal signal line [VL_1] but also from any horizontal signal line.

[Effects of the Invention]

As described in detail earlier, according to a photoelectric converter of the invention, the speeds of the control operations can be increased by performing only the second refresh operation as the refresh operation of the charge-sensitive sensors connected to the signal lines not being read.

Moreover, by performing a signal reading operation, the first refresh operation, and the second refresh operation for the charge-sensitive sensors of the signal lines being read during a prescribed period and by performing the second refresh operation for the charge-sensitive sensors of the signal lines not being read during a period other than the above-mentioned prescribed period, information can be read from the charge-sensitive sensors of selected signal lines at a higher speed. Moreover, since the refresh operation of only the charge-sensitive sensors of the signal lines not being read are performed during the accumulation period of the charge-sensitive sensors of the signals being read, it /367 becomes possible to achieve high-speed scanning and to shorten the blanking period.

4. Brief Explanation of the Drawings

Figure 1 is a circuit diagram showing one embodiment of a photoelectric converter of the invention.

Figure 2 is a waveform chart for explaining the operation of the above photoelectric converter.

Figure 3 is a magnified partial waveform chart of the part [A] of a V effective period.

Figure 4 is a magnified partial waveform chart of the part [B] of

a V blanking period.

Figure 5 is a waveform chart for explaining the operation of another embodiment of a photoelectric converter of the invention.

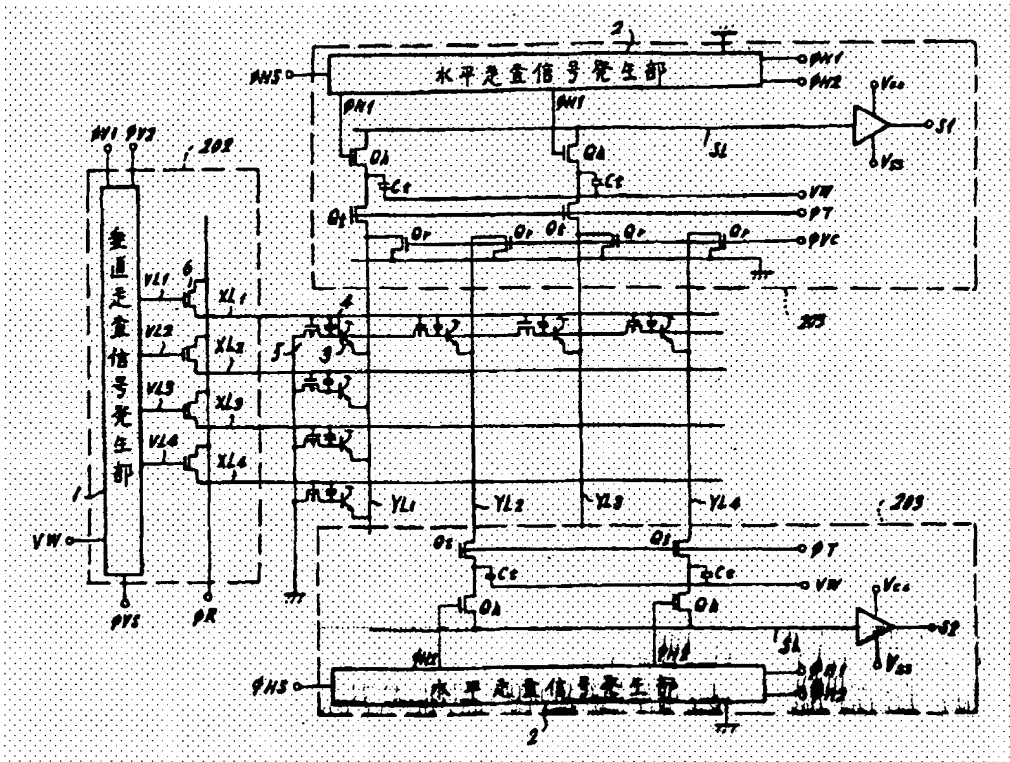
Figure 6 is a schematic structural drawing of one example of a photoelectric converter.

Figure 7 is a structural drawing of parts of the vertical scanning part and the photoelectric converting part of a photoelectric converter.

Figure 8 is a waveform chart for explaining the operations of the vertical scanning part and the photoelectric converting part.

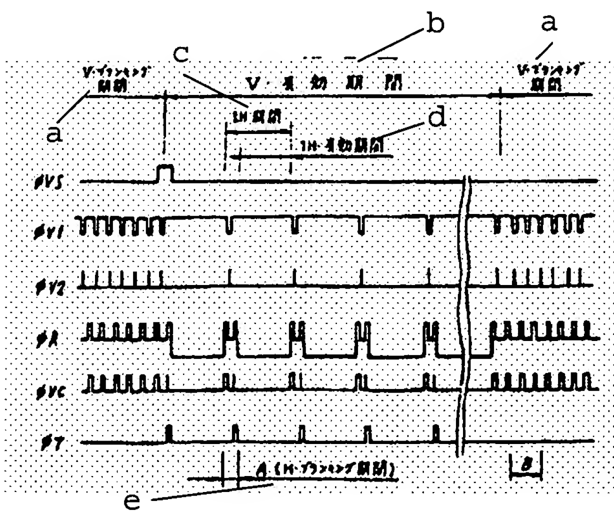
[1] = vertical scan signal generating part; [2] = horizontal scan signal generating part; [3] = output electrode; [4] = control electrode; [5] = P-type MOS transistor; [6] = buffer transistor; [XL_1] ~ [XL_n] = horizontal signal line; [YL_1] ~ [YL_n] = vertical signal line; [$Q_{[illegible]}$], [Q_n] = MOS transistor; [C_t] = accumulation capacitor; [SL] = output line.

[Figure 1]



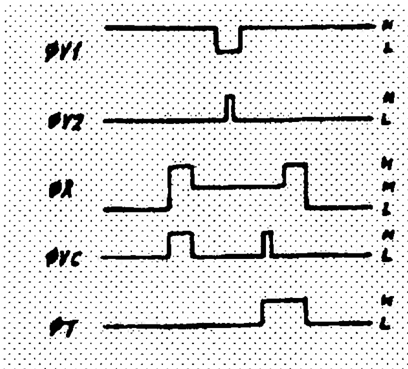
Key: 1) vertical scan signal generating part; 2) horizontal scan signal generating part.

[Figure 2] /368



Key: a) V blanking period; b) V effective period; c) 1H period; d) 1H effective period; e) A (H blanking period).

[Figure 3]



[Figure 4]

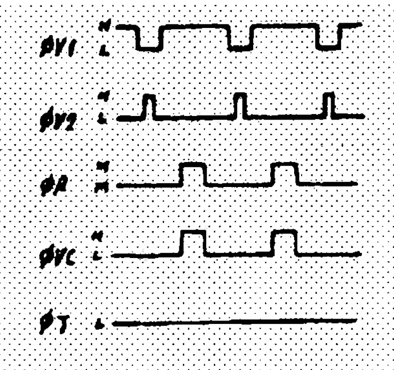
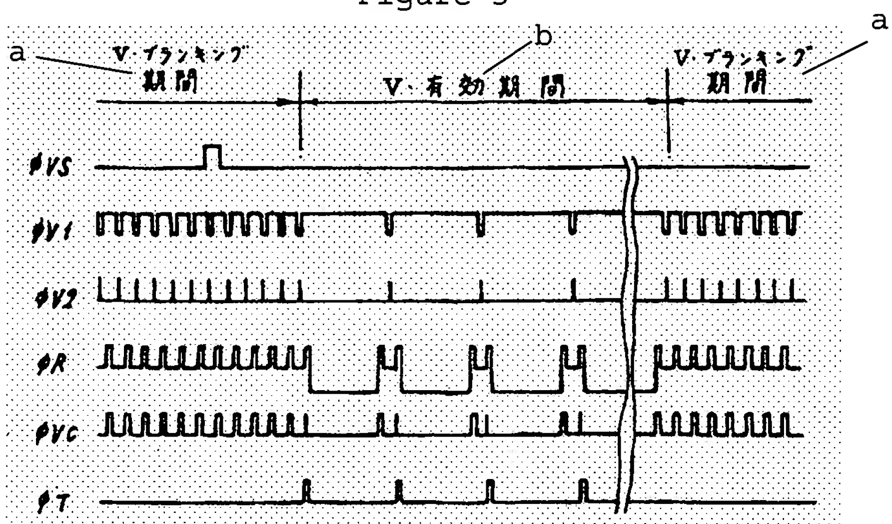
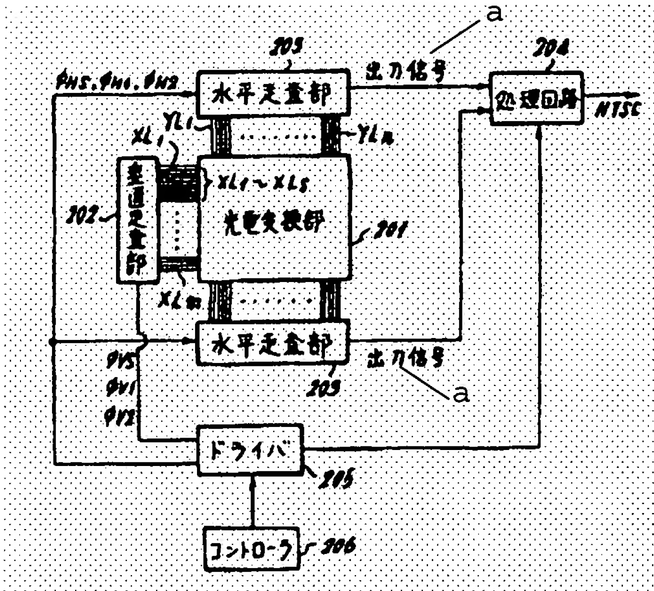


Figure 5



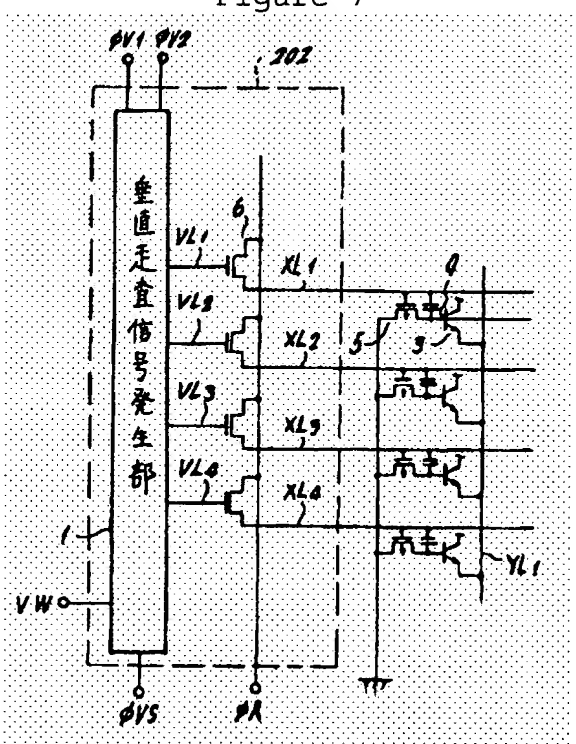
Key: a)V blanking period; b)V effective period.

Figure 6



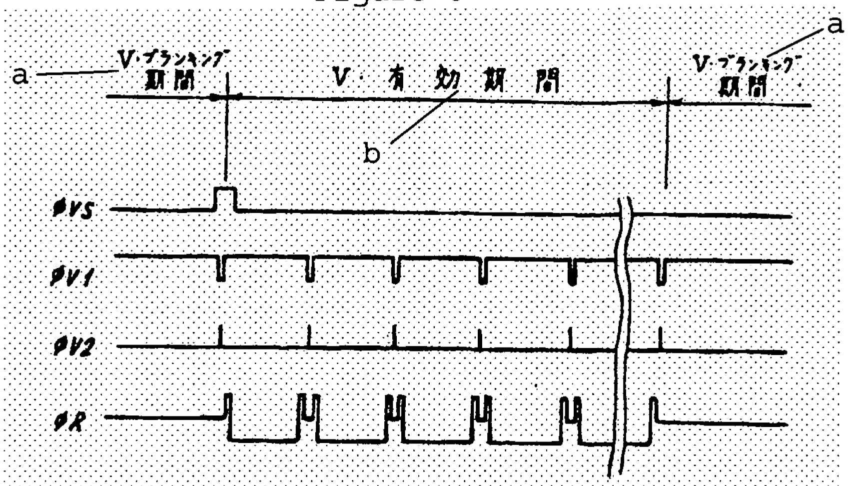
Key: 201)photoelectric converting part; 202)vertical scanning part; 203)horizontal scanning part; 204)processing circuit; 205)driver; 206)controller; a)output signal.

Figure 7



Key: 1)vertical scan signal generating part.

Figure 8



Key: a) V blanking period; b) V effective period.